

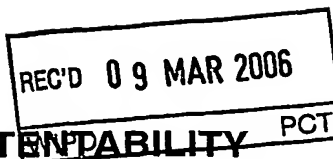
# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)





Applicant's or agent's file reference CCM016BWO	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. PCT/EP2004/011949	International filing date (day/month/year) 22.10.2004	Priority date (day/month/year) 06.11.2003
International Patent Classification (IPC) or national classification and IPC C01B3/38, B01J4/00, B01J8/02, B01J8/04, B01J19/26, B01F5/04, B01F15/02		
Applicant CASALE CHEMICALS S.A.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
  - a. ☒ sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:
    - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand  03.06.2005	Date of completion of this report  09.03.2006
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Engelen, K  Telephone No. +31 70 340-8971  

**INTERNATIONAL PRELIMINARY REPORT  
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International application No.  
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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-10 as originally filed

**Claims, Numbers**

3(part), 4-6, 14 as originally filed  
1, 2, 3(part), 7-13 received on 08.09.2005 with letter of 05.09.2005

**Drawings, Sheets**

1/3-3/3 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-14
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

- 1 Reference is made to the following documents:  
D1: EP-A-1 359 119 (NISSAN MOTOR) 5 November 2003  
D2: GB-A-2 305 186 (HITACHI LTD) 2 April 1997  
D3: WO 00/47517 A (CASALE CHEMICALS S A ;BEDETTI GIANFRANCO (IT)) 17 August 2000
- 2 **The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-9 and 14 does not involve an inventive step in the sense of Article 33(3) PCT.**
  - 2.1 Document D2 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses a reforming process and a fuel reforming apparatus. The cylindrical fuel reforming apparatus comprising a first zone, namely a reaction chamber, and a second zone, namely a catalyst bed, which are in fluid communication with each other (page 6, lines 21-27; figure 1). The apparatus also comprises a plurality of cylindrical ducts (for hydrocarbon, e.g. methane, air and steam supply), of which the air duct is inside of and coaxial with the hydrocarbon duct. All ducts are in fluid communication with the reaction chamber (page 7, lines 15-25; figure 1). Part of these ducts comprise internally a swirling device to give swirling motion to a fluid (here: steam) which crosses it (page 8, lines 15-21; figure 1). The longitudinal axes of the ducts are parallel with the longitudinal axis of the cylindrical shell. The reaction zone and the catalyst bed are divided by a plane which is perpendicular to the longitudinal axis of the cylindrical shell (figure 1).  
The only difference between the subject-matter of claim 1 and this known process is that a rotating swirling motion about the feed direction is given to the hydrocarbon gas flow and/or to the gas flow comprising oxygen, whereas in D2 a rotating swirling motion about the feed direction is given to the steam flow.  
The objective problem to be solved by the present invention may therefore be regarded as providing an alternative catalytic secondary process for the production of synthesis gas.  
The solution proposed in claim 1 of the present application cannot be considered as

involving an inventive step. A rotating swirling motion of one of the feed streams is created in order to improve the mixing of the feed streams und thus to obtain a more uniform temperature distribution, so as to allow the catalytic bed to operate in optimal conditions. Starting from D2, the person skilled in the art could only choose between giving a rotating swirling motion to either the methane flow, the oxygen containing gas flow and/or the steam flow. Therefore, the selection of giving a rotating swirling motion to the hydrocarbon gas flow and/or to the gas flow comprising oxygen is merely one out of a limited series straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.

- 2.2 The subject-matter of claim 1 is also not inventive with regard to D3. D3 (page 11, line 13 - page 27, line 1; figures 1 and 3) discloses a catalytic secondary reforming process and a reforming apparatus wherein a gas flow comprising oxygen and a gas flow comprising hydrocarbons are fed into a combustion chamber and are reacted upon mixing. The gas flow comprising the reaction products of the combustion are fed to a catalytic bed for carrying out a steam reforming process. The flows of reactant gases flow into the combustion chamber with a "substantial" axial motion (flow lines 18, 19 in figure 3).

The only difference between the subject-matter of claim 1 and this known process is that a rotating swirling motion about the feed direction is given to the hydrocarbon gas flow and/or to the gas flow comprising oxygen, whereas in D3 no rotating swirling motion about the feed direction is given to any of the feed streams.

The objective problem to be solved by the present invention may therefore be regarded as providing a catalytic secondary process for the production of synthesis gas in which a more uniform temperature distribution is obtained, so as to allow the catalytic bed to operate in optimal conditions (see also page 3, lines 4-11).

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step. A well-known and straight forward possibility for the person skilled in the art in order to obtain a more uniform temperature distribution is to create a better mixing of the reactant flows. D2 (page 5, lines 9-21) discloses that inter alia a swirl is given to one of the feed streams in order optimise the temperature distribution, so that the gas flowing into the reforming catalyst bed is adjusted to a temperature suitable for reforming in the catalyst bed.

The creation of a swirling motion in one of the feed streams as described in D2 thus

provides the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to include this feature in the process described in document D3 in order to solve the problem posed.

- 2.3 The processes of both present application, D2 and D3 are directed to multi-step processes for the production of hydrogen containing gas mixtures by reaction of gaseous or liquid hydrocarbons with gasifying agents using catalysts, independent of the use of the produced hydrogen containing mixture. They therefore belong to the same technical field.

- 2.4 Dependent process claims 2-6 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, involve an inventive step.

The additional features of claim 2 (selection of the second gas flow comprising oxygen for flowing a rotating swirling motion), of claim 3 (the hydrocarbon containing and the oxygen containing flows are one inside the other and coaxial), of claim 4 (the oxygen containing flow is inside and coaxial to the hydrocarbon containing flow) and of claims 5 and 6 (an opposite swirling motion is given to both the hydrocarbon containing flow and the oxygen containing flow) are simply straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.

- 2.5 Document D2 is regarded as being the closest prior art to the subject-matter of claim 7. Although figure 1 of D2 shows a reactor in horizontal position, it can also be used in vertical position.

The only difference between the subject-matter of claim 7 and this known apparatus is that the axis of the second duct (which comprises internally the swirling device) of present application is the same as axis of the reactor shell, whereas in D2, the axis of the ducts comprising internally the swirling device is not the same as the axis of the reactor shell.

The objective problem to be solved by the present invention may therefore be regarded as providing an alternative reforming apparatus for producing synthesis gas. The solution proposed in claim 7 of the present application cannot be considered as involving an inventive step. As the location of the ducts influences the mixing degree of the feed streams and thus the temperature distribution in the reactor, the choice of

where to locate them is simply the result of a series of optimisation experiments. Hence, starting from D2, the person skilled in the art would select the solution proposed in claim 7.

- 2.6 In reply to the written opinion the applicant argues that in the apparatus of D2, the swirling device is not comprised internally within a duct. However, even if this would be the case, this feature would not make the subject-matter of claim 7 inventive. The placement of the swirling device inside a duct or at the downstream end of a duct influences the swirling motion of the stream flowing through this duct and thus the mixing degree with other feed streams. Therefore, the choice of where to locate the swirling device with regard to the duct is simply one out of two straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.
- 2.7 For similar reasons as in paragraph 2.2, the subject-matter of claim 1 is also not inventive with regard to D3.
- 2.8 Dependent process claims 8, 9, and 14 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, involve an inventive step. The additional features of claim 8 (the swirling device is placed in a second duct, which is coaxial with a first duct, which in turn is inside of the second duct), claim 9 (the second cylindrical duct extends inside the reaction chamber) and claim 14 (a swirling device is also placed in the first duct) are simply straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.
- 3 **It is not at present apparent whether claims 10-13 or any other part of the application could serve as a basis for a main claim, which is novel and involves an inventive step.**

#### **Re Item VIII**

#### **Certain observations on the international application**

- 4 **Claims 1 and 7 do not fulfill the requirements of Article 6 PCT.**

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(SEPARATE SHEET)**

International application No.

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Terms, such as "**substantially** parallel" (claim 1) and "**substantially** vertical" (claim 7) are vague and imprecise and as such renders the scope of the claims unclear.